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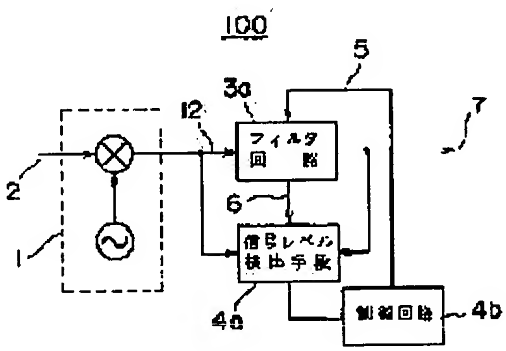
(54) FILTERING DEVICE AND RADIO RECEPTION EQUIPMENT

(57)Abstract:

PROBLEM TO BE SOLVED: To operate equipment with current consumption matched to the case of the communication service receiving period of a relax specification or satisfactory reception state although the device is operated with current consumption more than required in order to operate the circuit of the severest specification or to operate the device on the condition assuming the assumable worst receiving state.

SOLUTION: This device is provided with a frequency converting means for converting the frequency of an inputted signal, a filter circuit 3a composed of an analog circuit at least, a detecting means 4a for detecting the power of the entire signal inputted to the filter circuit part and the level of a desired wave or interference wave while using at least one of the output of the filter circuit 3a, the input of the filter circuit and the intermediate output of the filter circuit and a control circuit 4b for controlling at least one of the degree, circuit configuration and internal parameter of the filter circuit on the basis of the level of the input signal detected by the detecting circuit and a signal level in a filter band.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the wireless receiving set which is applied to the wireless receiving se used for a portable radio device, especially controlled the parameter of a filter circuit.
[0002]
[Description of the Prior Art] In recent years, the radio device which a user uses, carrying every day has spread remarkably like the electronic notebook equipped with a cellular phone, PHS (Personal Handyphone System), and communication facility, and especially the need of a radiotelephone has been increasing. Generally the power source ol a radiotelephone uses the cell in many cases, and many dry cells, such as an available manganese cell and an alkaline cell, are easily used in rechargeable batteries, such as a lithium ion battery, a nickel hydoride battery, etc. which can charge a cell, and in the city.
[0003] As these cells, the dry cell which can carry out long duration use is demanded by one charge by the rechargeabl battery which can use long duration, or one exchange, and development and a design of the wireless terminal which aimed at reduction-ization of the current consumed with improvement in the cell engine performance in the circuit in a radio device for that purpose are advanced positively. In these pocket mold wireless devices, the thing which has a small device serves as a component with which a cell occupies the volume most. As a recent trend, it is that to which the storage space of a cell was also restricted since a miniaturization and lightweight-ization of a device were desired, and since the power energy capacity of a cell is also restrained by restricting the size of a cell, although a radio device can be operated as much as possible also in the limited size for a long time, it is demanded.
[0004] Moreover, in recent years, since the communication service of various systems as a radiotelephony network is established, according to the use gestalt of the communication link system service to diversify, various received frequency, communication modes, and modulation techniques are also proposed, and whenever the walkie-talkie terminal piles up the generation, the number of communication service has been increasing. The terminal of the multimode which does not spoil the portability which may join two or more communication service among users, and can use two or more services by one set of a terminal is also beginning to be supplied. This multimode terminal mounts the wireless system according to received frequency, the communication mode, the modulation technique, etc. which the service which has joined is employing, and has become the structure which chooses the wireless system only for those services according to the service to be used.
[0005] However, at present, communication system is still built by hardware for every service, and this is generating problems, such as an increment in a mounting floor area ratio, and a rise of a manufacturing cost. Moreover, there is a problem that it cannot respond to modification of the communication service which the user has made a contract of etc. So, recently, a part sharable by the walkie-talkie uses the same circuit, and development of a multimode terminal whicl is performed by the system by reconstructible DSP (Digital Signal Processor) is furthered, without changing hardware about detection depending on a communication mode or a strange recovery method.
[0006] Every communication service of the hardware basic configuration of the analog circuit from [from the antenna of a walkie-talkie to an A/D converter] a D/A converter to an antenna is the same. If a receive section is explained using drawing, the signal received from the antenna 101 like drawing 22 will be once amplified by LNA(Low Noise Amplifier-low noise amplifier -) 102, and will carry out frequency conversion to an intermediate frequency band with the next frequency converter 104 through the filter 103 for interference wave oppression. In order to carry out frequency conversion to pan-head 1 SUBANDO so that the request wave by which selection magnification was carried out with - filter which carries out selection magnification of the request wave with the filter 107 which oppresses the interference wave used as the hindrance of a recovery may be applied to direct A/D converter 108, and it may be

changed into a digital signal from the input signal by which frequency conversion was carried out or the processing speed of an A/D converter can be caught up like drawing 23 , frequency conversion is carried out with the 2nd frequency converter 114.

[0007] The approach of carrying out frequency conversion of the input signal from an antenna to direct ** 1 SUBANDO like drawing 24 is also possible. After detection depending on a communication mode (modulation technique) is changed into a digital signal with an A/D converter, it is performed by digital processing.

[0008] The demand to changing received frequency, the band of a signal to receive, and the method of a modulation, i.e., the oscillation frequency of the local oscillator inputted into a frequency converter, the frequency bandwidth of an input signal, and a contiguity (interference wave) signal oppression ratio etc. means changing the concrete parameter of a circuit of operation, and changing communication service does not change the configuration of a circuit block theoretically.

[0009] The trouble of the conventional technique is explained based on the background described above. As for the component (LNA, a frequency converter, a filter, A/DD/A transducer) of the common area of a circuit which can respond to two or more communication service explained above, it is common that a design is most performed in two or more services whose correspondence is enabled based on stringent specification. However, the consumed electric current tends to increase the circuit which can respond to stringent specification. For example, in order to earn the dynamic range which improves the distorted property of a signal, the design which extends linearity operating range of broadband-izing is connected with the increment in the consumed electric current of a circuit as a result. Therefore, also while having received communication service with a loose specification, in order to make the circuit based on stringent specification operate most, it is made to operate by the consumed electric current beyond the need.

[0010] Moreover, the engine performance which can communicate good also in the severe conditions in which the use gestalt of a field radio is also various, and it is assumed, and deals must be maintained. For example, when [of receiving level] very low, receiving sensibility of a receive section must be made into max, and the high circuit of S/N (a signal / noise level ratio) must be operated. Or when the signal of the channel of a feeble request must be received while the circuit is crowded and a very big contiguity signal flies about, while raising receiving sensibility, it is necessary for it to be necessary to take large linearity operating range, such as a frequency converter and a filter, in order to make it a contiguity signal not receive interference of distortion, for it to be necessary to make the transition property of a filter steep namely, so that an A/D converter may not be saturated by the interference wave, and to raise the degree of a filter, and to take the high amount of interference wave oppression. Saying that the degree of a filter is increased means increasing the element number of the circuit of a filter, and since the active filter which used a transistor and amplifier is used, it is connected with the consumed electric current for operating the transistor used for a filter increasing by the end of today when the circuit is integrated.

[0011] Generally, a field radio is designed by the specification which can operate also in the case where the receive state which can be considered is the worst. This is connected with spending many consumed electric currents of a circuit and operating them as a result. However, the conditions of calling it the worst case here which can be considered are so few to the comprehensive time of a field radio in many cases. Since the circuit of the specification which assumed the worst case also usually is operated, almost all time amount will consume the consumed electric current beyond the need. Between the formation of long duration actuation of a field radio, and the convenience which can use two or more communication service in the situation of any reception by one set, the trouble which disagrees with each other in respect of the consumed electric current of a circuit is held.

[0012]

[Problem(s) to be Solved by the Invention] As mentioned above, during actuation of the field radio which can use two or more communication service, the conventional wireless receiving set always needs to pass actuation, i.e., the big consumed electric current, on the conditions that a specification is the severest, and its consumption of a cell is very early. Therefore, when using communication service with a loose specification, there was a problem that the time amount which can use this service by one charge or loading of a cell compared with the field radio received to dedication became short.

[0013] Moreover, when a receive state used it in a good environment, since the receive state was always carrying out actuation supposing the worst case, the circuit had the problem that the time amount which operates by the always big consumed electric current, and can also use this by one charge or loading of a cell became short.

[0014] It is made in order that this invention may solve the above-mentioned problem, and according to an operating environment, the power consumption of a terminal is stopped as much as possible, and it aims at offering the wireless receiving set which can extend the available time of a cell.

[0015]

[Means for Solving the Problem] In order to solve the trouble explained above, the filter equipment as 1st basic configuration of this invention The input signal level of the filter circuit constituted including the analog circuit at least and said filter circuit, A signal level detection means to detect at least one of the interstage output-signal level of a filte circuit, and the signal level in the filter band of a filter circuit, It has the control circuit which controls the parameter of said filter circuit based on the signal level detected with said signal level detection means.
[0016] Furthermore, the filter circuit constituted in the filter equipment concerning this basic configuration including the analog circuit at least, The A/D converter which changes the output signal of said filter circuit into a digital signal from an analog signal, The digital filter which filters a filter band signal from the digital output of said A/D converter, A signal level detection means to detect the signal level of the input of said digital filter, or an output, You may make i have the control circuit which controls at least one of the number of taps of said digital filter, the number of bits, and the sampling rates based on the input signal level detected by said signal level detection means.
[0017] Moreover, said analog filter controls at least one of a degree, a noise property, and the linearity input range, saic digital filter controls at least one of the number of bits and the numbers of taps, and you may make it said A/D converter control a sampling rate in the above-mentioned configuration.
[0018] Furthermore, said signal level detection means distinguishes the size of signal level with at least one threshold, and you may make it control at least one of the cut off frequency of said filter circuit, a degree, a noise property, and the linearity input range in the basic configuration of the above 1st according to this distinction result.
[0019] Moreover, you may make it control the noise property of said filter circuit in the above-mentioned configuratio by controlling at least one of the capacity value of the capacity value of the transconductance used in said filter circuit, and this filter circuit and a transconductance, and this filter circuit, and the resistance **s.
[0020] Moreover, you may make it control the linearity input range of said filter circuit in the above-mentioned configuration by controlling at least one of the resistance **s which determine the magnitude of the bias current inside the transformer conductor who constitutes said filter circuit, the operating point of this filter circuit, and the linearity input range.
[0021] Moreover, you may make it control the degree of said filter circuit by the change of the concatenation number of stages of said filter circuit, or the number of taps in the above-mentioned configuration.
[0022] Moreover, it integrates on the same semiconductor chip and you may make it constitute said filter circuit, an A/D-conversion circuit, a signal level detection means, and a control circuit in which the above-mentioned configuration.
[0023] Furthermore, the wireless receiving set concerning the 2nd basic configuration of this invention is characterized by to have the measuring circuit which measures a parameter convertible into a receiving error rate or a receiving error rate from the request wave which received to consecutiveness of the output of the filter circuit constituted including the analog circuit at least, and said filter circuit, and the control circuit which control the parameter of said filter circuit to become smaller than a predetermined error rate about the receiving error rate of the request wave obtained from said measuring circuit.
[0024] You may make it said control circuit control said filter circuit in the basic configuration of the above 2nd according to the rate of a data error and signal level of the input signal to the threshold which said measuring circuit measured a value, and the received field strength or signal level of the parameter corresponding to the error rate or erro rate of an input signal, prepared one or more thresholds at least at one side at the rate of a former data error, or signal level, distinguished, and was defined.
[0025] Moreover, you may make it control the degree of said filter circuit by the change of the concatenation number of stages of said filter circuit, or the number of taps in the above-mentioned configuration.
[0026] Furthermore, the wireless receiving set concerning the 3rd basic configuration The A/D converter which changes the band-limited input analog signal into a digital signal, The digital filter which filters a filter band signal from the digital output of said A/D converter, A signal level detection means to detect the signal level of the input of said digital filter, or an output, It is characterized by having the control circuit which controls at least one of the numbe of taps of a digital filter, the number of bits, and sampling rates based on the input signal level detected by said signal level detection means.
[0027] Furthermore, the wireless receiving circuit concerning the 4th basic configuration of this invention The analog filter circuit which considers the received signal as an input, and the A/D converter which changes the analog output of said analog filter circuit into a digital signal, The digital filter which filters a request wave from the digital output of said A/D converter, The matched filter which performs the back diffusion of electrons from the input signal outputted from said digital filter, It is characterized by having the control circuit which controls at least one of the linearity input range of an analog filter, a noise property, the number of taps of a digital filter, the number of bits, and the sampling

rates at least based on the signal level of said matched filter output.
[0028] the [moreover, / above-mentioned] -- you may make it control the linearity input range of said filter circuit in the 2nd or 3rd basic configuration by controlling the magnitude of the bias current inside the transformer conductor who constitutes said filter circuit, the operating point of a filter circuit, the resistance that determines the linearity input range, and at least one
[0029] Moreover, said measuring circuit prepares at least one threshold, and distinguishes the size of level, and you may make it said control circuit control at least one of the number of taps of said filter circuit, the number of bits, and the sampling rates in the above 2nd or the 3rd basic configuration according to this distinction result.
[0030] Moreover, you may make it control the noise property of said filter circuit in the 2nd or 3rd configuration of the above by controlling at least one of the transconductance used in said filter circuit, the capacity value which constitutes a filter circuit, a transconductance and capacity value, and the resistance **s. Moreover it controls the noise property of said filter circuit by controlling at least one of the transconductance used in said filter circuit, the capacity value which constitutes a filter circuit, a transconductance and capacity value, and the resistance **s, a filter circuit, an A/D-conversion circuit, and a control circuit integrate on the same semiconductor chip, and you may make it consist of basic configurations of the above 2nd in the configuration to the above-mentioned paragraph.
[0031]
[Embodiment of the Invention] Hereafter, the suitable operation gestalt of the wireless receiving set concerning this invention is explained, referring to an accompanying drawing. First, the wireless receiving set concerning the 1st operation gestalt of this invention is explained using drawing 1 thru/or drawing 12 .
[0032] Drawing 1 is the block diagram showing the basic configuration of the wireless receiving set concerning the 1st operation gestalt. In this drawing, the signal of the intermediate frequency region by which frequency conversion was carried out the signal of a radio frequency or once which received with the antenna enters from the signal input 2, and frequency conversion is carried out to an intermediate frequency region or a ** 1 SUBANDO band with a frequency converter 1. The interference wave which adjoins the output signal 12 of a frequency converter 1 in frequency at the request wave and coincidence which are going to receive at this time is also mixed in coincidence. The signal of the output signal 12 of a frequency converter 1 is inputted also into signal level detection means 4a which compares the level of the signal of I/O of filter circuit 3a while inputting it into filter circuit 3a which oppresses an interference wave

[0033] Moreover, signal level detection means 4a compares the signal level of the output terminal 7 of filter circuit 3a, or the level of the middle output signal 6 of filter circuit 3a with the signal level of the input signal 12 of filter circuit 3a. The comparison result of signal level detection means 4a is inputted into control circuit 4b, and control circuit 4b generates the signal 5 which controls a filter circuit 3. That a control circuit 4 compares are the signal level which also contains a request wave and an interference wave from the input of filter circuit 3a, and the signal level contained in a filter band from a filter output, and it measures whether the signal amplitude input range of a filter is crossed from the relation of the rate these 2 person's level.
[0034] When the level of a signal is large, filter circuit 3a is controlled through a control signal so that control circuit 4b enlarges the linearity input range to a filter. By controlling the linearity input range, it prevents that filter circuit 3a starts distortion, a request wave, and an intermodulation by an excessive interference wave etc., and trouble occurs in reception. When realizing filter circuit 3a by the active filter generally, if the linearity input range of filter circuit 3a is made to increase, it is common to make the power-source current consumed by filter circuit 3a increased. The detail about this is combined with the control approach of the linearity input range, and shows and mentions an example later Therefore, since it is not necessary to enlarge the linearity input range of filter circuit 3a while the level of an interference wave is small, the current consumed by filter circuit 3a can be extracted.
[0035] Moreover, when the level of I/O of filter circuit 3a is compared, the amount of oppression of an interference wave is measured and the amounts of oppression run short, as the degree of filter circuit 3a is changed through a control signal, the amount of oppression of an interference wave may be made to increase. Since it is increasing the element number of a filter circuit, increasing the degree of a filter will increase the number of the transistors which consume a power-source current, when realizing filter circuit 3a by the active filter, and it leads to making the consumed electric current increase. Therefore, when the level of an interference wave is small, the degree of filter circuit 3a can be lowered and the consumed electric current can be stopped.
[0036] Drawing 2 is the block diagram showing the example which changes the degree of a filter circuit. Filter circuit 3a has taken the configuration to which cascade connection of two or more filter blocks 81 was carried out. A filter bank 82 is the block of the secondary low pass filter with which the filter circuit of a low degree was constituted. The active filter of RC feedback mold by the operational amplifier constitutes this.

[0037] Of course, the filter using the transformer conductor who showed drawing 3 may realize. The power source of an operational amplifier or a transformer conductor is made to be supplied from the power-source line 87 through a switch 84. The line 88 which bypasses a filter bank is connected in addition to I/O of a filter bank 82, and he is trying for a signal line to change the path of an input signal with a switch 83. The number of the filter blocks 81 concatenated according to the required amount of interference wave oppression is changed corresponding to the communication service to receive, and a required degree is secured. The filter block which does not reduce and use a degree changes a signal line so that it may let the bypass line 88 pass, it opens an electric power switch 84 wide, and stops actuation of a filter bank.
[0038] Drawing 4 and drawing 6 are drawings showing an example of a transformer conductor circuit used in the filter circuit which constitutes the wireless receiving set of this invention. The example which constituted the filter using these transformer conductors is shown in drawing 3 . Here, although it is the example of implementation of a low pass filter (LPF) which is used by ** 1 SUBANDO, a band-pass filter is realizable similarly. A filter is constituted from combination of a capacitor with a transformer conductor, and a cut off frequency or resonance frequency is decided by the inverse number of a transformer conductor's mutual conductance, and the product of capacity value. When integrating a filter, since a configuration can be made simple, the configuration which makes capacity a fixed value, adjusts a transformer conductor's mutual conductance, and adjusts a cut off frequency and resonance frequency is in use. A mutual conductance is decided by setup of the bias voltage and the current which operate a transformer conductor's transistor.
[0039] The linearity input range of a transformer conductor is also controllable by bias voltage or the current. The example of drawing 4 is explained. First, the principle of operation of this circuit is explained. If the volt input of the differential signal is carried out from the input terminals 28 and 29 which become the gate of the input transistor 24, th output current proportional to input voltage will be outputted from an output terminal 25. With the configuration of a transistor 30, it serves to keep constant the electrical potential difference of the drain edges 31 and 32 of the input transistor 24 to an amplifier 22. It is set as an electrical potential difference equal to the electrical potential difference applied to the control terminal 23 by work of feedback of an amplifier 22. By applying an electrical potential differenc on which the input transistor 24 operates the electrical potential difference applied to the control terminal 23 in a linearity field, the drain current of close KATORANJISUTA 24 flows in proportion to the electrical potential difference (namely, electrical potential difference applied to input terminals 28 and 29) applied to the gate. Since an output terminal 25 outputs the current which succeeded the current of the input transistor 24 as it was, it can take out the output current proportional to the electrical potential difference applied to input terminals 28 and 29.
[0040] Drain current Id which flows to an input transistor It is expressed with a bottom type (1) while the input transistor 24 is operating in the linearity field.
[0041]
[Equation 1]

$$I_d = \frac{KW}{2L} \left(2 (V_{gs} - V_{th}) V_{ds} - V_{ds}^2\right) \qquad (1)$$

K：デバイスに依存する定数、W：ゲート幅、L：ゲート長、V_{gs}：ゲート印加電圧、V_{th}：しきい値電圧、V_{ds}：ドレイン電圧

The range of the gate voltage (namely, common operating point electrical potential difference) of the input transistor 2 which can operate without making a signal distorted is explained using drawing 5 . Drawing 5 is a level diagram which shows the input operation possible range of the transformer conductor of drawing 4 . The common electrical potential difference Vin impressed to input terminals 28 or 29 is put on an axis of ordinate, and the case where the sweep of the Vin is carried out from zero is considered. Here, a transistor 24 sets constant the electrical potential difference (namely Vds of a transistor 24) applied to the control terminal 23 with the value within the limits which operate in a linearity field. Vin is Id at zero to a formula (1). Electrical potential difference used as forward [0042]
[Equation 2]

$$Vth + V_{ds}^2 / 2$$

A transistor 24 does not operate between until. Furthermore, it is Id so that the relation of a formula (1) may show, when Vin is raised. It increases infinite at primary rate theoretically. However, in the usage direction who returns and connects a transformer conductor's I/O like the filter circuit of drawing 3 , the output voltage range of a transformer

conductor also receives a limit. Since it connects with the power supply terminal 21 through the transistor of the curren mirror 26, an output terminal 25 is the electrical potential difference Vdsp between the drain sources of supply voltage Vcc to a current mirror transistor. The deducted electrical potential difference serves as an upper limit.

[0043] Next, the linearity input range of the circuit of drawing 4 and the relation of the consumed electric current are explained. In drawing 5 , since the operating point comes in the center of the range which can carry out linearity actuation of the transformer conductor as shown in drawing when a common electrical potential difference is sufficiently large Vc1, it can operate to linearity also on the electrical potential difference of the big amplitude. However, since the bottom puts [a common electrical potential difference] with the operating point in front of a threshold electrical potential difference (Vc2) below in the threshold electrical potential difference of an input transistor, large amplitude actuation cannot be performed. However, since the drain current of the stationary passed to the input transistor 24 increases in proportion to the magnitude of the common electrical potential difference Vin, if it i the level of the signal amplitude which can operate to linearity enough by Vin=Vc2, as for the direction operated by Vin=Vc2, saving can do the drain current of a stationary rather than making it always operate in the operating point of Vin=Vc1.

[0044] Next, control of the linearity input range etc. is explained about the example of drawing 6 . The signal input of an electrical potential difference is applied from the reversal input 47 of an amplifier 41, and it states transistor 42, and is impressed by 1 SU. The noninverting input of an amplifier 41 is connected at the collector nodes 52 and 53 of a transistor 42. Feedback starts by this, and the electrical potential difference of nodes 52 and 53 operates so that it may become equal to input terminals 46 and 47 respectively. If a differential electrical potential difference is impressed to input terminals 46 and 47, the same differential electrical potential difference as the both ends of resistance 45 will be added according to a feedback operation of amplifier 41. Then, the current according to Ohm's law flows for resistance 45, and a difference arises in the collector current of a transistor 42. There is relation to the electrical potential difference between 1 SU emitters shown in a bottom type (2) to the collector current of a transistor 42, and it is [0045].

[Equation 3]

$$V_{be}=V_T \ln\left(\frac{Ic}{Is}\right) \qquad (2)$$

V_{be}：ベース・エミッタ間電圧、V_T ：熱起電力（２６mV）、Is ：遮断電流

The output voltage which stated transistor 42 according to this property, and carried out logarithmic compression of th input signal to the terminals 54 and 55 of 1 SU as a result occurs. the signal level by which logarithmic compression was carried out is connected to the latter part -- it states differential pair transistor 46, and is added to 1 SU, and characteristic conversion on a current from an electrical potential difference is performed here. Since conversion actuation with a transistor 46 performs the transistor 42 and inverse transformation which perform logarithmic compression, it can take out a linearity current output from the current output terminal 48 to input voltage.

[0046] The linearity input range of this circuit is decided by faithfully [so how far] linear transformation of the curren which flows to resistance 45 is carried out on an input signal electrical potential difference. The current which may flow to resistance 45 if supply voltage has secured sufficiently greatly is the current I1 which flows to a current source 43. It cannot flow above. Therefore, the linearity input range Vlinear of this transformer conductor will be decided by relation of a formula (3).

Vlinear=REEI1 (3)

REE: The resistance of resistance 45, I1 : Current of a current source 43 [0047] Moreover, transconductance Gm It is expressed with a bottom type (4).

[0048]

[Equation 4]

$$Gm = \frac{I_2}{I_1 R_{EE}} \qquad (4)$$

I_2 ：電流源４４の電流

In order to enlarge the linearity input range, it becomes whether the value REE of resistance 45 is enlarged, or to increase a current I1. It is a current I1 to enlarge the value of resistance 45 in order for the thermal noise generated in resistance 45 to also become large when considering mounting in an integrated circuit the problem of the increment in occupancy area of resistance arises, and to degrade a transformer conductor's noise property. Increasing is common.

[0049] It is the current I1 passed from the linearity input range needed first to the value REE and transistor 42 of resistance 45 when designing this transformer conductor. It is decided. For resistance, the one where a value is larger is a current I1. Although it is advantageous since it can save, an upper limit is decided by the limitation of the specification of a noise property, or the size at the time of being accumulated. When LSI is generally accumulated, several kohms - number 10komega are realistic as resistance. Next, current I2 passed to a transistor 46 from Gm needed by the transformer conductor It determines.
[0050] When using a transformer conductor with a filter, control of Gm which determines the time constant of a filter is needed. If it is the circuit of drawing 6 , it is a current I1. It is I2 although what is necessary is just to control I2 or REE It becomes possible by controlling Gm to control independently of the linearity input range easy moreover. Drawing 7 shows the concrete example which changes a bias current, in order to perform a transformer conductor's Gm, and control of the linearity input range. For example, it is the explanation of the example of ****** changed in response to the control signal of a filter circuit by the transformer conductor of drawing 6 .
[0051] Drawing 7 (a) arranges in juxtaposition the current source (for example, I, I/2, I/4 --) 57 set to the fixed current ratio, and is the approach of connecting these current sources to juxtaposition with a switch 58, and going so that it may become a required bias current value. Instead of changing with a switch, actuation of the current source beforehand connected to juxtaposition altogether may be stopped, or the approach which has harnessed enough and is carried out may be used. Drawing 7 (b) is the example which realized concretely the current change of the sources 43 and 44 of a bias current using the current mirror of a transistor. The constant current source used as criteria is connected to the bias source-of-supply connection terminal 62, and it connects with the current source terminal 63 as a current source, and uses for it.
[0052] Although this drawing showed the example which used the bipolar transistor, an MOS transistor can be constructed similarly. What is necessary is just to change the combination of the parallel connection of the transistor defined by the ratio with fixed gate size besides changing the number of the simple substance transistors which will connect to juxtaposition the number of the simple substance transistors which will connect with emitter size or juxtaposition if it is a bipolar transistor if it is an MOS transistor. An exact current ratio can be changed in the range of the relative error of a device by this, and a highly accurate bias current can be controlled.
[0053] Drawing 8 (a) shows the example which controls the value of resistance of electrical-potential-difference current conversion, in order to control the linearity input range of a transformer conductor. For example, it is an effective example, when changing the value of the resistance 45 of the circuit of drawing 6 and controlling the linearity input range. It is realistic to use for a switch 58 the analog switch which used the CMOS transistor, and it is the technique suitable for integration. Drawing 8 (b) connects the current source of a bypass to resistance 45 at juxtaposition instead of changing the value of resistance 45, and shows the example which changes the maximum of the current passed to resistance 45, and controls the linearity input range of the transformer conductor 40.
[0054] The transconductance Gm of the transformer conductor 74 who uses for filter circuit 3a as shown in drawing 3 changes drawing 9 , and it shows one example of the direction. A transformer conductor's Gm is adjustable by changing a bias current, as explained above. However, the control of Gm by the bias current is unsuitable technique, when a large control range cannot be taken but the single or more figures band (that is, time constants, such as a cut off frequency) of a signal changes like this walkie-talkie. The transformer conductor 74 who operates by Gm of the regular ratio is arranged in juxtaposition, and it is the method which changes number and combination of the transformer conductor 74 who does parallel connection so that it may become required Gm value. Although the change of Gm with the continuous method to change cannot be performed, it is possible to take the large width of face changed to condition of being the level of twice as many - [as this] a single figure. In order to stop power consumption, as for the separated transformer conductor 74, it is desirable to drop a power source.
[0055] The example of the relation between the noise property (S/N) of a filter and the consumed electric current of a filter and the control approach of S/N of a filter is explained briefly. Generating [in a low pass filter circuit as shown in drawing 3] noise voltage <Vn2> is the total Ctot of the capacity which constitutes a filter. There is relation like a bottom type (5).
[0056]
[Equation 5]

$$\left\langle V_n^2 \right\rangle \propto \frac{kT}{C_{tot}} \qquad (5)$$

k：ボルツマン係数、T：絶対温度

It is desirable to use the largest possible value for capacity with the filter as which a low noise is required so that the relation of a formula 5 may show. low -- in order to realize a noise filter (S/N -- high), it is necessary to enlarge capacity Gm must also be increased when a time constant is considered as fixed, and enlarging capacity. Since a transformer conductor's consumed electric current increases in proportion to Gm, occasionally the high filter of S/N cannot but carry out big actuation of the consumed electric current which is the need. When S/N is not needed, if capacity is dropped and Gm is dropped on coincidence, it can stop the consumed electric current beyond the need.
[0057] In this example, although the low pass filter was explained, it can say that the same is said of a band-pass filter. If capacity value and resistance are changed, whenever [cusp] (Q value) will change and S/N will change from change of the amount of loss of the signal near resonance frequency. In order to suppress loss, maintaining Q value and to earn a transformer conductor's gain, if it is going to take high S/N, the consumed electric current will increase.
[0058] It is the approach which the approach of arranging a transformer conductor and capacity in juxtaposition like drawing 9 R> 9 as the concrete technique of stopping the consumed electric current, and changing with a switch tends to realize. Moreover, a noise property is improved from the technique of the technique of carrying out parallel connection of the Gm as the control technique of S/N not only contributing to reduction of the consumed electric currents, but controlling Gm by one transformer conductor to explain below. Drawing 10 is the explanatory view of the model which added the noise generated in a transformer conductor simple substance as an equivalence noise voltage source. As shown in drawing, the equivalence noise voltage source 78 joins the transformer conductor's 74 input. The noise current generated in transformer conductor 74 output is per transformer conductor [0059].

[Equation 6]

$$\sqrt{\left\langle v_n^2 \right\rangle} Gm$$

**** generating is carried out. When a transformer conductor's Gm doubles, noise current also doubles as it is. However, when it arranges to two transformer conductor juxtaposition of the same Gm value, in order that there may be no correlation in the noise voltage which each other transformer conductor generates, output noise current is [0060].

[Equation 7]

$$\sqrt{\left\langle v_{n1}^2 \right\rangle + \left\langle v_{n2}^2 \right\rangle} Gm$$

It comes to be alike. It is [0061] when the average of noise voltage is equal.

[Equation 8]

$$\left\langle v_{n1}^2 \right\rangle = \left\langle v_{n2}^2 \right\rangle = \left\langle v_n^2 \right\rangle \text{より} \sqrt{2\left\langle v_n^2 \right\rangle} Gm$$

It becomes. That is, for the direction which connected two pieces to juxtaposition for the same transformer conductor o Gm, the magnitude of output noise current is [0062].

[Equation 9]

$$1/\sqrt{2}$$

It becomes small only twice. When the same Gm is similarly connected to n piece juxtaposition, it is [0063] rather than it carries out one transformer conductor's Gm n times (however, n integer).

[Equation 10]

$$1/\sqrt{n}$$

Noise current can be made small only twice.
[0064] Although the example of Gm-C IRUTA using a transformer conductor was explained above, it can say that the same is said of RC feedback mold active filter using an operational amplifier. In order to earn S/N of a filter, the principle that it is necessary to increase the capacity which determines the time constant of a filter is the same. Instead, the resistance which determines a time constant must be lowered. When capacity value is raised and resistance is lowered, the ON appearance KAIMPI dance of a filter falls and the capacity for the output of the number transducer of subharmonics to drive a filter is needed. Moreover, it is necessary to prepare the powerful output stage which can drive the impedance to which the operational amplifier also became low.

[0065] The configuration for which the output stage of an operational amplifier used the emitter (source) follower, and the bias current which passes to the transistor of an output stage for a pushOpull circuit etc. is in use and improving drive capacity (to that is, extent to which it is not distorted at the time of the large amplitude, either) are enlarged. When dealing with the same signal level, since the current which passes S/N for the component of the taken filter circuit increases, the consumed electric current cannot but increase. However, when you do not need S/N, capacity is dropped like a Gm-C filter, and if it enables it to raise resistance 27 so that relation of a time constant may not be broken down into coincidence, it can suppress the drive capacity of the output stage of the operational amplifier to need. It is the approach which the approach of putting two or more capacity and resistance in order beforehand, and changing as the implementation approach if needed tends to realize. The approach of drawing 7 or drawing 8 can apply the change of bias control of the output stage of an operational amplifier, or resistance as it is.

[0066] Drawing 11 is the circuit diagram showing the 1st example of a comparator circuit 4. However, the comparator circuit shown here is restricted to what carries out relative measurement of the signal level of I/O of analog filter 3a in the 1st operation gestalt shown in drawing 1 . In the example of drawing 11 , a signal input is one and inputs the signal of either the input of a filter, or an output. Since the input level of the signal used as the standard of the linearity input range should just observe the peak value of a signal, it samples the peak value of the inputted signal level in the peak hold circuit 121, and inputs some of this peaking capacity into the comparator 122 connected to juxtaposition. A comparator 122 evaluates size relation with reference voltage [the reference voltage according to the threshold set up beforehand / respectively].

[0067] Each comparator output outputs the high corresponding to amplitude level, or one of low values as a control output 126 through a latch circuit 123. A control output signal may be used as change signals (connection, a bias current, etc. of resistance, capacity value, and a transformer conductor) of the parameter of a direct filter, and may change and use a control output signal for an analog value by the D/A converter considered as an input. Since a control signal and a peak hold circuit are reset whenever the assigned slot period expires and measurement and control are again performed between outside a self-slot period when the signal to treat is divided by the slot, it can respond also to fluctuation of conditions with time.

[0068] Drawing 12 is the circuit diagram showing the 2nd example of a comparator circuit 4. This example as well as the 1st example is effective technique to analog filter 3a shown by drawing 1 . A signal input carries out the peak hold of each I/O of those with two, and a filter circuit here. The signal which carried out the peak hold takes difference with the subtraction vessel 127. With the output of the subtraction machine 127, change of the amount of oppression of the adjacent channel signal in a filter is detected. The output of the subtraction machine 127 is inputted into two or more comparators 122 which carry out an electrical-potential-difference comparison with the reference voltage corresponding to the threshold set up beforehand. As for each output of a comparator, a high or one of low values is outputted to a control output 126 through latch 123.

[0069] The actuation using the example of drawing 12 is explained. For example, the linearity input range is beforehand set as min for a filter, and a signal is inputted. When the adjoining interference wave is large, a filter circuit starts distortion and an intermodulation and a distorted component mixes it in a band. If an interference wave and an intermodulation do not start, with the output of filter circuit 3a, an interference wave is oppressed with a filter and the level of a request wave should not change by 0dB conversion of gains in a band of a filter. Therefore, if the relation of the total signal level in I/O of filter circuit 3a does not have an intermodulation, the direction of an input level should become larger than an output level (input-level > output level).

[0070] Conversely, when so large that the level of an interference wave crosses the linearity input range, in order that intermodulation distortion may mix in a band, as for the relation of the I/O level of a filter, an output level will become large rather than an input level (input-level < output level). The output of the subtraction machine 127 changes a polarity according to the size relation of both level, and changes the magnitude of a differential signal with the magnitude of intermodulation distortion. What is necessary is just to make it control start so that the output of the subtraction machine 127 may become zero so that the linearity input range of a filter circuit may be extended and intermodulation distortion may be lost that is, since it means that the linearity input range of a filter circuit is too small when intermodulation distortion occurs.

[0071] Two examples shown in drawing 11 explained above and drawing 12 may be used together. By drawing 11 , since the ratio for noise level of an input signal is known, it uses as an index of S/N control of a filter. Since the level o an interference wave can be distinguished by drawing 12 , this should just control the linearity input range of a filter circuit.

[0072] Although the example explained above becomes when receiving the signal to input analogically, it can consider a detector realizable besides these. By the example of drawing 13 - drawing 16 , since it encodes as a digital signal, the

signal level in I/O of digital filter 3b is [the digital block 110 interior] realizable with digital data processing. It is also possible to build a detector by software and to process by the microprocessor. In that case, a program is changed according to the gestalt of the communication service to be used, and few useless flexible terminals can consist of building the detector suitable for the system.

[0073] Drawing 13 is the block diagram showing the 2nd operation gestalt of the wireless receiving set of this invention. From the output which changed the output of filter circuit 3a into the digital signal, and detected it with A/D converter 8, the detection means 16 detects the error rate of the data contained in a request wave. In order for the error rate of data to change depending on how to distort the wave of a request wave, the distortion property of filter circuit 3a will depend for it on the rate of a data error. Although it is better to make the degree and linearity input range of a filter as small as possible in order to stop the consumed electric current of a filter, the limit by degradation of the receiving error rate of a request wave is received.

[0074] Then, the parameter corresponding to the rate of a data error or the rate of a data error of a detection output is measured in a control circuit 9, the linearity input range of filter circuit 3a controls based on this result, and control which the rate of a data error becomes in tolerance is performed. Since there is no need of always taking the large margin of the linearity input range of filter circuit 3a in order to secure the predetermined rate of a data error, and making it operating in any situations by this, it becomes effective in reduction of the consumed electric current. moreover, the common operating point of not only controlling the width of face of the linearity input range but a filter circuit -- the core of a linearity active region -- or since the approach of controlling the operating point of a circuit at the place which an input signal can receive by low distortion most does not need to extend the linearity input range beyond the need, either, so that signal amplitude may be settled in linearity operating range even if it changes the common operating point, it is effective in the reduction in the consumed electric current.

[0075] Drawing 14 is the block diagram showing the 3rd operation gestalt of the wireless receiving set of this invention. Digital filter 3b which connects the roll-off filter which prevents the intersymbol interference other than filter circuit 3a of an analog configuration after A/D converter 8 may constitute. Occupancy area of a circuit may be able to be made small or the consumed electric current may be able to be saved rather than this realizes a roll-off filter analogically. In this case, the signal level in I/O of a digital filter is measured, and it may be made to control the linearity input range of filter circuit 3a according to the level of a signal.

[0076] Or the approach of controlling the operating point of a circuit also has the common operating point of filter circuit 3a effective in the core of a linearity active region, or the place which an input signal can receive to low distortion most. A control signal may have a digital output as it is as a control signal (for example, switch change signal) of filter circuit 3a, and may be, and you may use by making a comparator output into an analog signal by the digital-to-analog converter. Since digital processing performs measuring the level of an interference wave by I/O of digital filter 3b, a configuration strong against the detection error by the outpatient department noise and disturbance of a detecting element is realizable.

[0077] Although the example which uses for control of analog filter 3a the control signal 5 which is the output of a control circuit 4 was explained, it is possible to save the consumed electric current consumed by the digital filter when a low degree and the number of taps are enough by preparing independently control signal 5b to digital filter 3b, and performing the change of the degree of a digital filter or the number of taps. Moreover, although the number of bits of A/D converter 8 may be changed according to the level of an interference wave, it is also possible to reduce the consumed electric current in a digital filter by changing the number of bits of digital filter 3b according to this.

[0078] Moreover, drawing 15 is the example for which it was suitable when spectrum diffusion of the signal was carried out and the signal of two or more channels was multiplexed. The signal of the digital filter output 13 is in the condition that the signal of two or more channels by the signal in a filter band was multiplexed. Selection reception of the signal of a channel to receive with a matched filter 15 from now on is carried out. Since the output of a matched filter can take out the amplitude of the signal of a channel to receive, it should just control the parameter of a filter circuit 3 by the control circuit 4 based on this signal.

[0079] Drawing 16 is the block diagram showing the 5th operation gestalt of the wireless receiving set of this invention. An error rate (or parameter corresponding to an error rate) may be measured from the detection output signal 7 in a detector 16, and digital filter 3b other than analog filter 3a may be controlled for control to which the rate of a data error is subsided in tolerance. Control of analog filter 3a is performed about a degree, the linearity input range, and the common operating point, and control of the number of bits, or the degree and the number of taps is performed about digital filter 3b. Here, it is attached to the detection approach of the receiving error rate (henceforth, BER) in a detector 16, and explains. At a mobile terminal, a receiving error rate can usually be measured using the known signal part of the time slots assigned to the local station.

[0080] Drawing 17 is drawing showing an example of the frame structure for explaining this technique. In this example, the frame consists of four slots from S1 to S4, and the inside of a slot consists of a preamble (PR), unique WORD (UW), and information part (I), error detecting code (CRC), etc. Here, it judges whether BER was beforehand observed by one slot or two or more slots using the known part, for example, UW part, at the terminal, and BER became beyond the threshold. What is necessary is to assume receiving a slot S1 and just to perform parameter control to a circuit in the example of drawing 18 , on the basis of the average of BER observed at UW section of the self-slot shown in 2201.

[0081] By this technique, since the time amount section which performs error rate detection is the part to which it was restricted in the slot as shown in drawing 18 , in order for precision to improve BER detection, it is necessary to take the average of two or more slots over a long time. In order to prevent this, the following technique may be used as the technique of presuming BER, without using a known signal. That is, the aperture condition of the eye pattern of the base band signal sampled in the latter part of A/D converter 8 for BER presumption is observed in a detector circuit 11. And what is necessary is to set a threshold to the aperture condition of an eye, the amplitude, etc., to judge it as what BER degradation has produced, when less than this threshold, and just to perform parameter control to a circuit.

[0082] By this technique, since BER presumption can be performed using the time amount of all self-slots as shown in 2301 of drawing 19 , it is accurate for a short time and the necessity of control can be judged. In this case, of course, the direction after digital one may detect detection of an eye in the analog stage of the A/D-converter 8 preceding paragraph but theoretically easily. That is, it is technique applicable also to the 1st operation gestalt shown in drawing 1 . Moreover, for BER presumption, RSSI (received field strength) is measured, and when detected RSSI becomes smaller than a threshold, if BER degradation has occurred, you may ****. Also by this technique, as shown in 2301 of drawing 19 , BER presumption can carry out using the time amount of all self-slots. The analog section, the digital section, or either can detect RSSI detection.

[0083] Drawing 20 is the transition diagram showing the 6th operation gestalt in connection with the wireless receiving set of this invention. For BER presumption, CRC (Cyclic Redundancy Code: error detecting code) may be used. if BEI quality has deteriorated when a CRC error arises more than the count of a convention slot -- ****** -- things are made. Moreover, BER presumption may be performed using both CRC detection and RSSI detection. With [when a CRC error occurs / a RSSI detection value] a threshold [beyond], the cause of a CRC error can be judged to be what originates distorted. In this case, what is necessary is just to perform parameter control, such as extending the linearity input range of a filter circuit. Moreover, with [when a CRC error occurs / a RSSI detection value] a threshold [below], the cause of a CRC error can be judged to be a thing resulting from thermal noise.

[0084] In this case, what is necessary is to lower the value of the resistance 45 of drawing 20 , or just to perform parameter control, such as raising the value of a bias current, in order to improve S/N of a circuit. Moreover, a parameter setup which raises the gain of a circuit can also be performed. Moreover, when it is judged that it detected and phasing has occurred whether phasing has arisen for BER presumption, you may make it regard it as BER degradation. For example, in the case of a walkie-talkie equipped with the diversity function, if phasing arises, diversit will be performed frequently. What is necessary is to **** with BER degradation and just to perform parameter contro to a circuit, when this frequency becomes beyond a threshold. In addition, when BER detected or presumed by the above technique holds the good value in the predetermined time amount section, S/N of a circuit and distortion **** with what is set up beyond the need, it is the range where the property of a walkie-talkie is maintained at worst, for example, a parameter can also be controlled to lower power consumption.

[0085] Drawing 21 shows the transition diagram explaining the 7th operation gestalt of invention in connection with the wireless receiving set of this invention of operation. It is the table showing the relation of the level of a request wave and an interference wave, and the relation of the mode of operation of a filter circuit. At least one or more thresholds 201 are formed in the judgment of the receiving level of the request wave and interference wave which are detected by I/O of a filter circuit, respectively, for example, in every one case, the combination in four kinds of modes 202 can do the threshold 201 of a level judging in a request wave and an interference wave like the example of drawin 21 . The optimal operating condition for these modes 202 is set up, the specification of a filter circuit when a receive state is good is eased, and the consumed electric current is saved.

[0086] The threshold 201 for mode 202 change may change by preparing two or more according to the fineness of required control. The size of a channel range is equivalent to the linearity input range of a filter circuit by drawing 21 , and if the linearity input range is extended, the consumed electric current of a filter circuit will increase. S/N is dependent on the bias current of the transistor of the input stage which constitutes a transformer conductor. Since it is in inverse proportion to the square root of the drain current of an MOS transistor when especially an MOS transistor is used, S/N is improved for the direction which passed many bias currents. It is more desirable for the resistance 45 of

electrical-potential-difference current conversion to be main noise sources, and to make the value of resistance 45 smal in the example of the configuration by the bipolar transistor, for example, drawing 6 . On the other hand, maintaining the fixed linearity input range, lowering the value of resistance 45 means increasing the bias current of the input transistor 42, and it leads to the increment in the consumed electric current.

[0087]

[Effect of the Invention] the service which is received in the pocket mold radio set which can receive two or more communication service according to the wireless receiving set concerning this invention as explained to the detail above -- the minimum -- a circuit can be operated by required power consumption. Moreover, since it becomes unnecessary to always carry out actuation supposing the case where a receive state is bad, while a receive state is good, the consumed electric current of a circuit can be stopped. consequently, useless consumption of the cell used as the power source of a terminal -- it can stop -- one charge of a cell -- or extension of the time amount which can use a terminal by one exchange can be aimed at sharply.

[Translation done.]

* NOTICES *

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The block diagram of the filter equipment by the 1st operation gestalt of this invention.
[Drawing 2] The circuit diagram showing the example of implementation which changes the degree of a filter circuit.
[Drawing 3] The circuit diagram showing the example of implementation of the filter using a transformer conductor.
[Drawing 4] The circuit diagram of the transformer conductor of the filter used with the wireless receiving set of this invention.
[Drawing 5] The explanatory view of the linearity operating voltage range of a transformer conductor.
[Drawing 6] The circuit diagram of the transformer conductor of the filter used with the filter equipment and the wireless receiving set of this invention.
[Drawing 7] The circuit diagram showing the example of implementation of a current source change circuit.
[Drawing 8] A resistance change circuit, the circuit diagram showing the example of implementation of a linearity input range change.
[Drawing 9] The circuit diagram showing the example of implementation of a change of a transconductance.
[Drawing 10] The explanatory view of noise voltage generated from a transformer conductor.
[Drawing 11] The circuit diagram showing the 1st example of a comparator circuit.
[Drawing 12] The circuit diagram showing the 2nd example of a comparator circuit.
[Drawing 13] The block diagram showing the configuration of the wireless receiving set concerning the 2nd operation gestalt of this invention.
[Drawing 14] The block diagram showing the configuration of the wireless receiving set concerning the 3rd operation gestalt of this invention.
[Drawing 15] The block diagram showing the configuration of the wireless receiving set concerning the 4th operation gestalt of this invention.
[Drawing 16] The block diagram showing the configuration of the wireless receiving set concerning the 5th operation gestalt of this invention.
[Drawing 17] The frame and slot block diagram for explaining an example of error rate measurement.
[Drawing 18] The frame structure Fig. for explaining an example of error rate measurement.
[Drawing 19] The frame structure Fig. for explaining an example of error rate measurement.
[Drawing 20] The transition diagram of operation showing actuation of the wireless receiving set concerning the 6th operation gestalt of this invention.
[Drawing 21] The transition diagram of operation showing actuation of the wireless receiving set concerning the 7th operation gestalt of this invention.
[Drawing 22] The block diagram explaining a pocket mold wireless receiving set.
[Drawing 23] The block diagram explaining a pocket mold wireless receiving set.
[Drawing 24] The block diagram explaining a pocket mold wireless receiving set.
[Description of Notations]
1 Frequency Converter
2 Signal Input
3 Filter Circuit
3a Analog filter circuit
3b Digital filter circuit
4a Signal level detection means
4b, 9 Control circuit

5 5b Control signal
6 Middle Output of Filter
7 Filter Output Terminal
8 A/D Converter
11 Wave Detector
12 Frequency-Converter Output or Filter Input Terminal
13 Digital Filter Output Terminal
15 Matched Filter
16 Detector
20 Transformer Conductor Circuit

[Translation done.]

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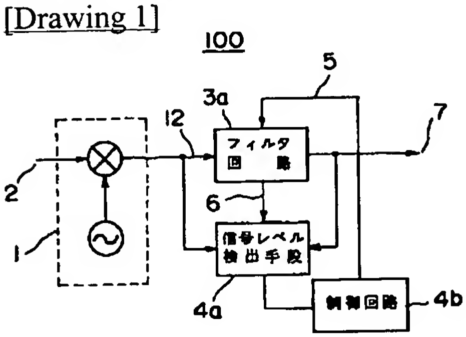
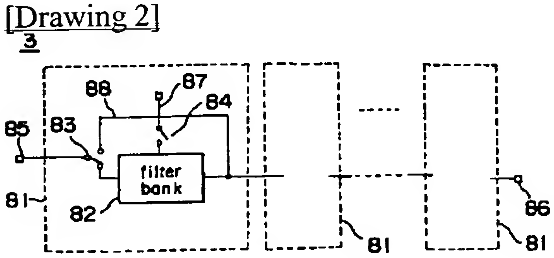
DRAWINGS

[Drawing 1]



[Drawing 2]



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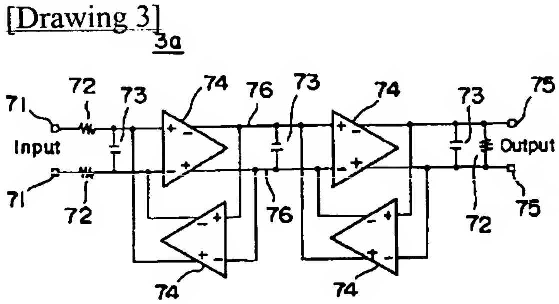

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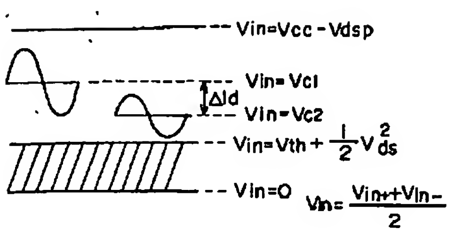

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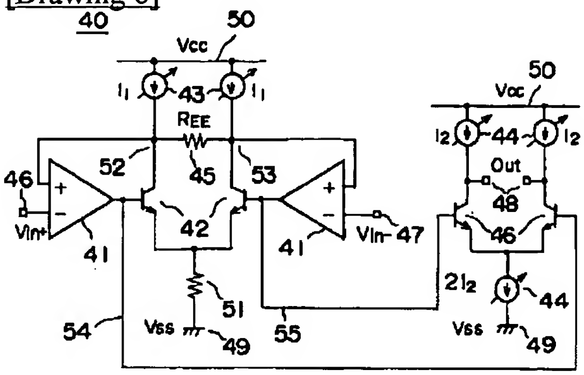

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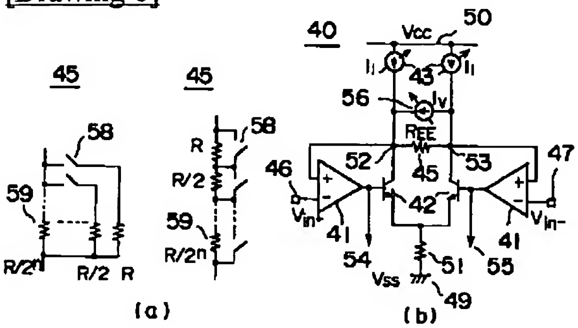

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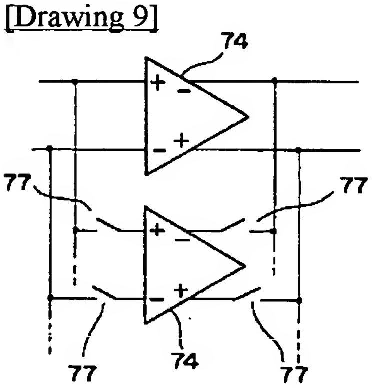

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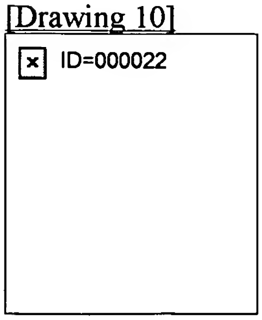

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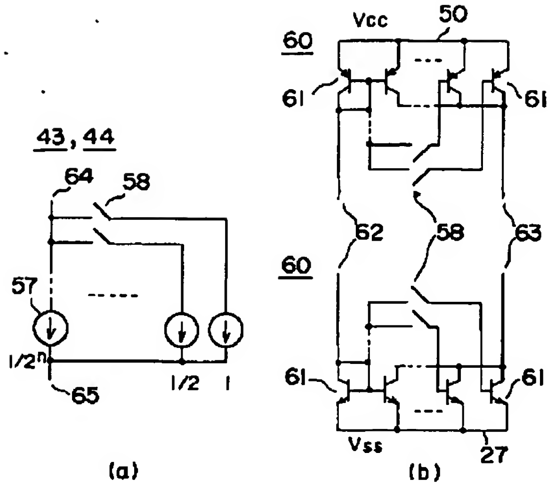
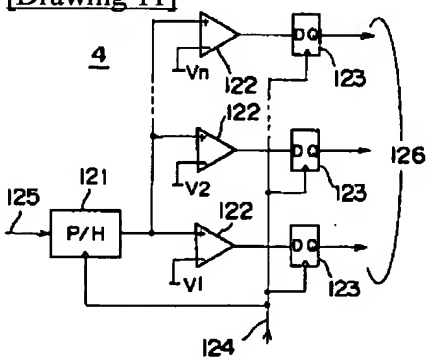
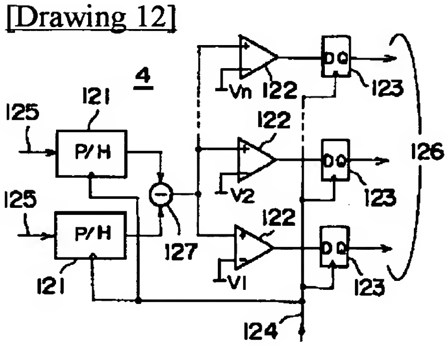


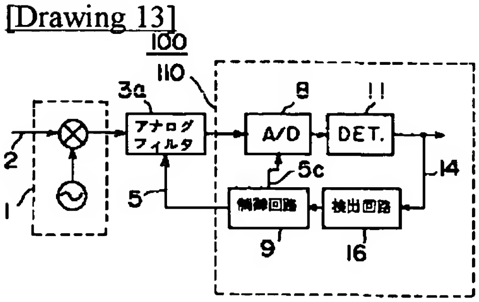
[Drawing 11]



[Drawing 12]



[Drawing 13]



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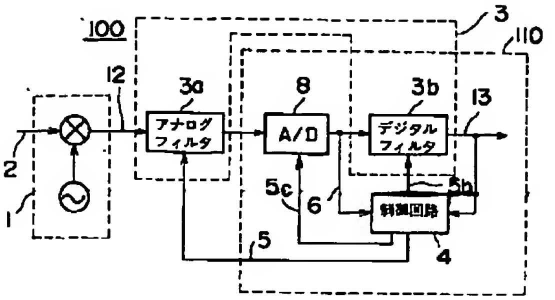
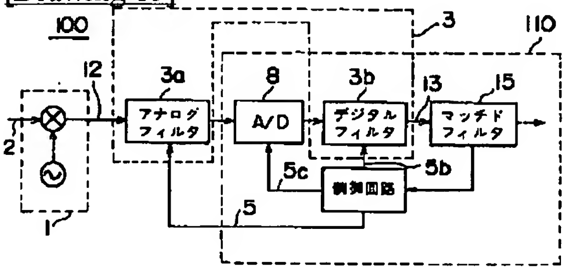


[Drawing 15]



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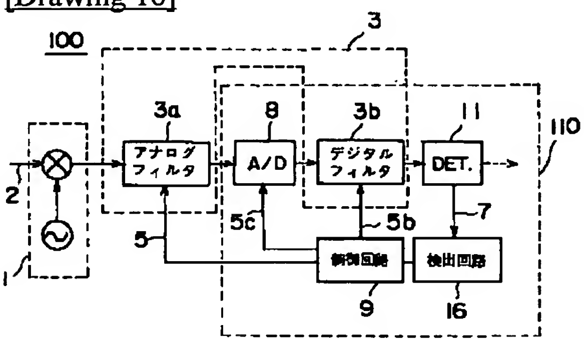

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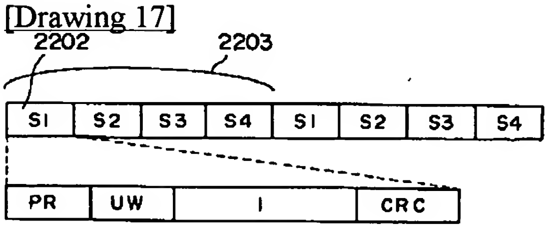

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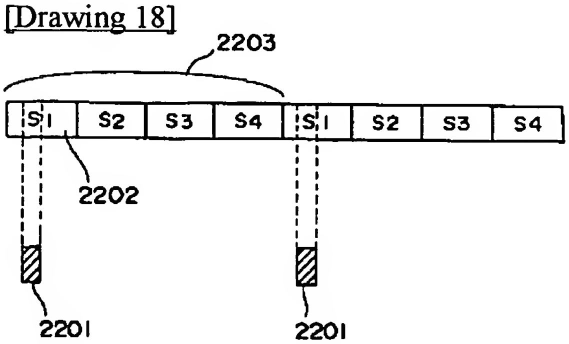

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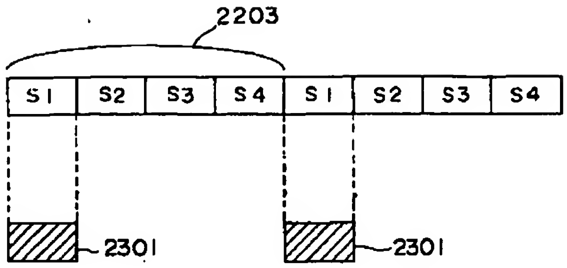

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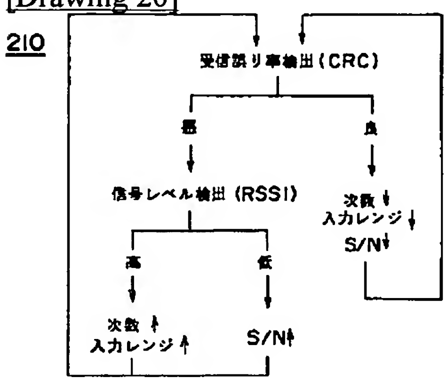

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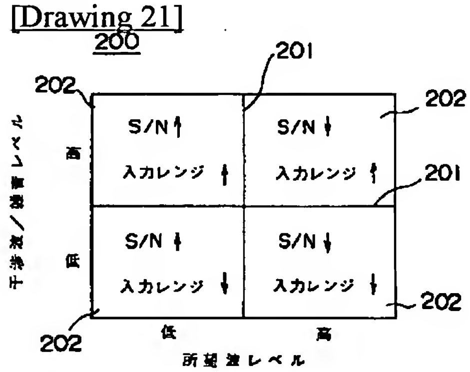

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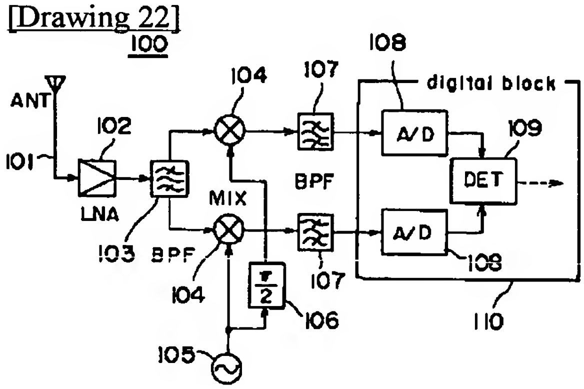
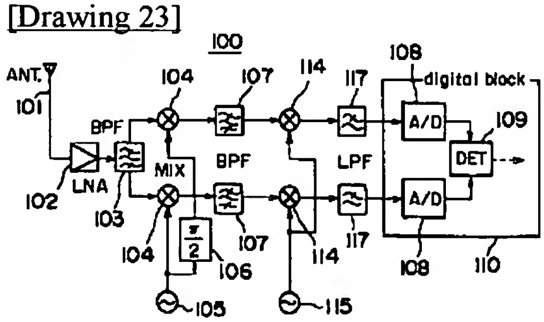
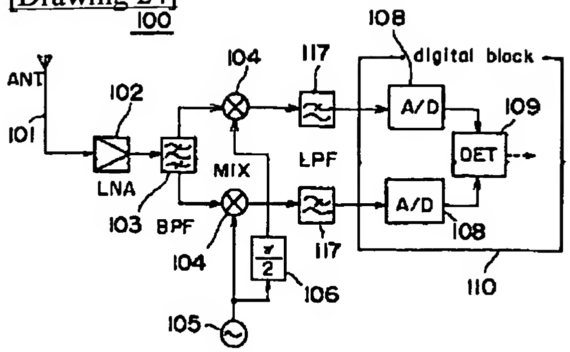


[Drawing 23]



[Drawing 24]



[Translation done.]

CLAIMS

[Claim(s)]
[Claim 1] Filter equipment characterized by having a signal level detection means to detect at least one of the input signal level of the filter circuit constituted including the analog circuit at least, and said filter circuit, the interstage output-signal level of a filter circuit, and the signal level in the filter band of a filter circuit, and the control circuit which controls the parameter of said filter circuit based on the signal level detected with said signal level detection means.
[Claim 2] The filter circuit constituted including the analog circuit at least, and the A/D converter which changes the output signal of said filter circuit into a digital signal from an analog signal, The digital filter which filters a filter band signal from the digital output of said A/D converter, A signal level detection means to detect the signal level of the input of said digital filter, or an output, Filter equipment characterized by having the control circuit which controls at least one of the number of taps of said digital filter, the number of bits, and the sampling rates based on the input signal level detected by said signal level detection means.
[Claim 3] It is filter equipment according to claim 2 characterized by for said analog filter controlling at least one of a degree, a noise property, and the linearity input range, for said digital filter controlling at least one of the number of bit: and the numbers of taps, and said A/D converter controlling a sampling rate.
[Claim 4] Said signal level detection means is filter equipment according to claim 1 or 2 characterized by distinguishing the size of signal level with at least one threshold, and controlling at least one of the cut off frequency of said filter circuit, a degree, a noise property, and the linearity input range according to this distinction result.
[Claim 5] Filter equipment according to claim 4 characterized by controlling the noise property of said filter circuit by controlling at least one of the capacity value of the capacity value of the transconductance used in said filter circuit, anc this filter circuit and a transconductance, and this filter circuit, and the resistance **s.
[Claim 6] Filter equipment according to claim 4 characterized by controlling the linearity input range of said filter circuit by controlling at least one of the resistance **s which determine the magnitude of the bias current inside the transformer conductor who constitutes said filter circuit, the operating point of this filter circuit, and the linearity input range.
[Claim 7] Filter equipment according to claim 4 characterized by controlling the degree of said filter circuit by the change of the concatenation number of stages of said filter circuit, or the number of taps.
[Claim 8] Filter equipment of any of said filter circuit, an A/D-conversion circuit, a signal level detection means and claim 1 characterized by integrating the control circuit on the same semiconductor chip thru/or claim 6, or a publication.
[Claim 9] The wireless receiving set characterized by having the measuring circuit which measures a parameter convertible into a receiving error rate or a receiving error rate from the request wave which received to consecutivenes: of the output of the filter circuit constituted including the analog circuit at least, and said filter circuit, and the control circuit which controls the parameter of said filter circuit to become smaller than a predetermined error rate about the receiving error rate of the request wave obtained from said measuring circuit.
[Claim 10] Said measuring circuit is a wireless receiving set according to claim 9 characterized by said control circuit controlling said filter circuit according to the rate of a data error and signal level of the input signal to the value of the parameter corresponding to the error rate or error rate of an input signal, and the threshold which measured received field strength or signal level, prepared one or more thresholds at least in one side, distinguished to the rate of a former data error, or signal level, and was set to it.
[Claim 11] The wireless receiving set characterized by to have the control circuit which controls at least one of the number of taps of a digital filter, the number of bits, and sampling rates based on the input signal level detected by the

A/D converter which changes the band-limited input analog signal into a digital signal, the digital filter which filters a filter band signal from the digital output of said A/D converter, signal level detection means detect the signal level of the input of said digital filter, or an output, and said signal level detection means.

[Claim 12] The analog filter circuit which considers the received signal as an input, and the A/D converter which changes the analog output of said analog filter circuit into a digital signal, The digital filter which filters a request wave from the digital output of said A/D converter, The matched filter which performs the back diffusion of electrons from the input signal outputted from said digital filter, The wireless receiving set characterized by having the control circuit which controls at least one of the linearity input range of an analog filter, a noise property, the number of taps of a digital filter, the number of bits, and the sampling rates at least based on the signal level of said matched filter output.

[Claim 13] Said measuring circuit is a wireless receiving set according to claim 11 or 12 characterized by preparing at least one threshold, distinguishing the size of level, and said control circuit controlling at least one of the number of taps of said filter circuit, the number of bits, and the sampling rates according to this distinction result.

[Claim 14] The wireless receiving set according to claim 10 or 13 characterized by controlling the linearity input range of said filter circuit by controlling the magnitude of the bias current inside the transformer conductor who constitutes said filter circuit, the operating point of a filter circuit, the resistance that determines the linearity input range, and at least one.

[Claim 15] The wireless receiving set according to claim 10 or 13 characterized by controlling the degree of said filter circuit by the change of the concatenation number of stages of said filter circuit, or the number of taps.

[Claim 16] The noise property of said filter circuit is a wireless receiving set according to claim 10 or 13 characterized by controlling by one [at least] control of the transconductance used in the filter circuit, the capacity value which constitutes a filter circuit, and resistance.

[Claim 17] A wireless receiving set given in any of claim 9 characterized by integrating the filter circuit, the A/D-conversion circuit, and the control circuit on the same semiconductor chip thru/or claim 16 they are.

[Translation done.]